Review Article

Women with Heart Failure and the Need for Tailored Cardiac Rehabilitation Programs

Mariya Prakash Jiandani[1], Henita Joshna Menezes[2], Agalya Neelamegam[3], Hetan Shah[4], Priya Chockalingam[5]

[1]Physiotherapy School and Centre, Seth GSMC and KEMH, Mumbai, Maharashtra, [2]Manipal School of Nursing, Manipal College of Nursing, Manipal Academy of Higher Education, Manipal, Karnataka, [3]Cardiac Wellness Institute, Chennai, Tamil Nadu, [4]King Edward Memorial Hospital, Mumbai, Maharashtra, India, [5]Cardiac Wellness Institute, Chennai, Tamil Nadu, India

Abstract

Heart failure (HF) remains a major contributor to cardiovascular morbidity and mortality globally, with distinct sex-specific differences in epidemiology, pathophysiology, and clinical outcomes. While HF with reduced ejection fraction (EF) is widely researched, women who present with HF with preserved EF experience diagnostic delays and face significant barriers to accessing cardiac rehabilitation (CR). The objectives of this review were to critically appraise the biological, psychosocial, and health-system factors influencing HF outcomes in women, evaluate the evidence on CR effectiveness in this population, and propose tailored CR strategies suitable for the Indian healthcare context. This comprehensive narrative review summarized and integrated global and Indian literature by including epidemiological studies, randomized trials, meta-analyses, qualitative research, and clinical guidelines, focusing on CR and HF care in women. The review identified multiple barriers limiting women's participation in CR, including caregiving responsibilities, poor awareness, sociocultural constraints, referral bias, and limited program availability. While there is strong evidence supporting CR benefits in HF, with the most consistent improvements observed in exercise capacity and health-related quality of life, a likely modest reduction in HF-related and all-cause hospital admissions, and with mortality benefits less consistently demonstrated, women remain underrepresented in trials and programs. Tailored CR models, including home-based, hybrid, tele-rehabilitation, and culturally adapted interventions, show improved feasibility and acceptability in women. In summary, India-specific, sex- and gender-responsive CR adaptations are urgently needed, particularly in rural and underserved settings. Implementing women-centered referral pathways and flexible CR delivery supported by policy action, clinician training, and targeted research is essential to close the sex-equity gap and improve long-term HF outcomes for women.

Keywords: Cardiac rehabilitation, health services, heart failure, sex factors, women, women's health

Key Messages:

- Women with HF experience distinct biological risk exposures, disproportionate symptom burden, and unique psychosocial and healthcare challenges.
- These gendered challenges often limit access to, reduce participation in, and hinder deriving benefits from CR.
- Tailored, women-centered CR programs can address unmet needs and improve reach, accessibility, acceptability, and functional recovery for Indian women across HF phenotypes.

Introduction

Heart failure (HF), a clinical syndrome encompassing diverse etiologies, is currently defined as a condition with symptoms and/or signs caused by a structural and/or functional cardiac abnormality, and corroborated by elevated natriuretic peptide levels and/or objective evidence

Access this article online

Quick Response Code:

Website: https://journals.lww.com/hfji

DOI: 10.4103/HFJI.HFJI_4_26

Address for correspondence: Dr. Priya Chockalingam, Cardiac Wellness Institute, Chennai 600090, Tamil Nadu, India.
E-mail: priyachockalingam@cardiacwellnessinstitute.com

Submitted: 29-Jan-2026 **Revised:** 26-Feb-2026
Accepted: 26-Feb-2026 **Published:** 05-May-2026

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 License (CC BY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Jiandani MP, Menezes HJ, Neelamegam A, Shah H, Chockalingam P. Women with heart failure and the need for tailored cardiac rehabilitation programs. Heart Fail J 2026;4:39-51.

of pulmonary or systemic congestion.[1,2] HF affects over 64 million people today, making it an emerging global epidemic that is expected to increase in prevalence with the rise in the aging population.[3] Given that prognosis and therapeutic response differ with phenotype and most clinical trials enroll patients by ejection fraction (EF), left ventricular EF (LVEF) remains central to HF classification in clinical practice and research. In this narrative review, HF with reduced EF (HFrEF) is defined as LVEF ≤40%, HF with mildly reduced EF (HFmrEF) as LVEF 41%–49%, and HF with preserved EF (HFpEF) as LVEF ≥50%.

India's Heart Failure Burden and the Under-recognized Impact on Women

Estimates suggest that India experiences over a million incident HF cases annually. Indian and regional studies indicate that ischemic and hypertensive heart diseases account for a large share of HF, while cardiomyopathy and valvular heart disease remain important contributors, particularly in socioeconomically disadvantaged and rural populations.[4-6]

Sex-disaggregated Indian registry data on acute HF patients showed that women constitute one-third of admissions, are slightly older than men, and are more likely to present with HFpEF and hypertension, whereas men more often had ischemic heart disease (IHD) as the underlying substrate.[5] However, age at presentation varies across Indian settings. Indian data demonstrate heterogeneity by geography and socioeconomic context, with some regional and rural cohorts reporting younger age at presentation and differing etiologic patterns compared with urban, cardiometabolic-driven pathways.[6]

Cardiac Rehabilitation in Heart Failure and Women: Rationale and Aim of the Review

Comprehensive CR, consisting of structured exercise training, nutritional guidance, psychosocial counseling, and health education, is a cornerstone of HF management. Evidence demonstrates improvements in exercise capacity, symptom burden, functional independence, psychological well-being, and quality of life (QoL) in HF patients completing CR.[7] However, traditional CR models have been largely designed based on data on working middle-aged men, with women's needs being grossly under-addressed.[8] Women are more likely to downplay symptoms to avoid burdening family, report higher psychological distress after cardiac events, and have lower self-efficacy, alongside functional constraints and comorbidities that can limit physical activity. These challenges are relevant in HF, where high symptom burden, multimorbidity, caregiver responsibilities, and psychosocial distress often interact with health-system barriers to reduce CR participation, reinforcing the case for women-centered and context-adapted CR pathways.[9] Comorbidities, particularly anemia, hypertension, diabetes, chronic obstructive pulmonary disease, chronic kidney disease, and atrial fibrillation/flutter, are common in women and directly influence exercise tolerance, safety monitoring, and program completion.[4]

Accordingly, CR programs in India must be phenotype-aware and comorbidity-responsive with discharge-based referral as the key "capture point" for women after HF hospitalization. In this context, Indian registry data serves as the most practical "needs assessment tool" for CR design, referral prioritization, and risk stratification. The biological, functional, and psychosocial needs influence exercise prescription, adherence, and long-term engagement in rehabilitation programs. Moreover, emerging data suggest that a large proportion of HF risk in women may be modifiable, highlighting the potential impact of structured lifestyle and rehabilitative interventions delivered through CR.[10]

Where global epidemiology provides essential context, India-specific HF case mix, particularly phenotype distribution and multimorbidity, will ultimately determine what CR must deliver in real-world settings in our population. Hence, there is a clear need to re-appraise CR delivery through a gender-specific lens. A narrative review approach is well-suited to integrate evidence across diverse study designs, clinical contexts, and healthcare settings and translate into implementation strategies. Therefore, this narrative review aims to synthesize existing evidence on HF in women with a specific focus on CR, examine sex- and gender-specific responses and barriers to CR participation, and propose tailored CR models that are feasible and relevant to the Indian healthcare context while preserving the core components of comprehensive CR.

Materials and Methods

A targeted literature search was conducted across PubMed/MEDLINE [Supplementary File 1], Scopus, CINAHL, Web of Science, Google Scholar, and ProQuest for English-language publications from January 1, 2015, to December 31, 2025. Search terms combined concepts related to: (1) Population (women/female sex); (2) condition (HF, HFpEF, HFrEF, and HFmrEF); (3) intervention (CR, comprehensive CR, exercise-based CR, home-based CR, hybrid CR, and tele-CR, including technology-enabled and tele-rehabilitation models); and (4) approach (tailoring or personalization, gender-responsive, and culturally adapted interventions). In addition, reference lists of key guidelines, systematic reviews, and landmark studies were hand-searched to identify seminal and context-relevant publications. Studies focusing on women, women-only cohorts, or providing sex-disaggregated analyses were

prioritized where available. We excluded pediatric studies, non-HF primary populations, case reports, editorials without original data, and conference abstracts without full text.

Study identification and selection

The search retrieved 361 records (PubMed/MEDLINE: 271; Scopus: 36; CINAHL: 0; Web of Science: 1; Google Scholar: 16; ProQuest: 37). Google Scholar was used primarily for citation chasing and identification of key implementation reports, rather than as a stand-alone systematic database. Only English-language publications were included; Titles and abstracts were screened for relevance to women with HF and CR, including alternative CR delivery formats (home-based, hybrid, and tele-rehabilitation). Following title and abstract screening, 37 records proceeded to full-text assessment. After full-text screening, 14 studies met eligibility criteria and were included in the narrative synthesis; 23 full-text records were excluded because they did not meet the review scope and eligibility criteria.

Findings were narratively synthesized (without statistical pooling) under major thematic areas aligned with the scope of this review: Epidemiology and women with HF, biopsychosocial determinants of HF in women, implementation barriers to CR referral, enrollment and completion, exercise and safety considerations, effectiveness and evidence gaps for CR in women, program design considerations for India, and future research needs. India-specific evidence (e.g., Indian HF registries, CR audits, and India- or low and middle-income countries [LMIC]-based trials) was preferentially used to inform context-specific recommendations. Where direct Indian evidence was limited, recommendations were explicitly framed as transferable LMIC/global evidence or expert-informed implementation proposals.

No formal risk-of-bias appraisal was performed, consistent with a narrative review methodology; limitations, including English-language restriction and potential publication/language bias relevant to LMIC literature, are acknowledged. Ethical approval was not required because this study synthesized published literature.

While the term HFmrEF (LVEF 41%–49%) is included for definitional completeness, the emphasis of this review is on HFpEF and HFrEF as they dominate clinical pathways and evidence syntheses relevant to women and CR.[11]

In this review, "sex" refers to biological attributes (e.g., anatomy, physiology, and hormones), whereas "gender" refers to sociocultural roles, norms, and relations that influence exposures, care-seeking, and access to services. We use "women-focused CR" to mean CR adaptations intended to improve reach and engagement for women (e.g., flexible scheduling, home-based/hybrid/tele-CR options, women-tailored education and psychosocial support, and, where acceptable, women-only sessions), consistent with International Council of Cardiovascular Prevention and Rehabilitation (ICCPRO) guidance.

Women with heart failure: What we know

Beyond sex differences in prevalence and the distribution of traditional risk factors, a growing body of literature supports the role of female-specific biological and reproductive exposures in shaping HF presentation, particularly the predominance of HFpEF among women.[12] Across Indian HF registry studies, women represented 17%–50% of the study population, with most cohorts enriched for HFrEF presentations.[13] However, Indian data suggest that the true prevalence of HF in women is probably underestimated due to underdiagnosis and poor data systems.[14]

Female-specific and female-predominant exposures include peripartum cardiomyopathy, pregnancy-related hypertension, and chemotherapy-induced cardiotoxicity, alongside rising obesity and hypertension. Sex-related differences in cardiac structure, such as small chamber size and greater concentric remodeling, symptom perception, and health-seeking behaviors further influence presentation, diagnostic pathway, and outcomes, reinforcing the need for gender-responsive care pathways.[13,15]

HFpEF in postmenopausal women is increasingly understood as a systemic syndrome in which vascular, metabolic, and peripheral limitations interact with cardiac diastolic reserve to produce exertional intolerance.[12] Declining estradiol has been implicated through effects on inflammation, oxidative stress, nitric oxide signaling, and endothelial function, with downstream adverse cardiometabolic changes that amplify HFpEF risk.[12,16-19] Because microvascular and endothelial dysfunction are implicated in HFpEF, related ischemia syndromes (e.g., Angina with Non-Obstructive Coronary Arteries/ Ischemia with Non-Obstructive Coronary Arteries/ Myocardial Infarction with Non-Obstructive Coronary Arteries [MINOCA]) may coexist in some women; exercise-based CR may plausibly improve functional capacity and vascular health, but sex-specific outcome data remain limited.[20]

Clinical profile: How women with heart failure are different from men

Women with HF often report a higher symptom burden and poorer QoL than men despite similar disease severity and are less likely to receive guideline-directed medical and device therapies.[21] However, sex alone does not consistently determine prognosis. In a large cohort of women hospitalized with acute decompensated HF, one-year mortality and survival outcomes were comparable to those of men.[22] Population-based studies

indicate that modifiable lifestyle and cardiovascular risk factors (smoking, alcohol use, body mass index (BMI), hypertension, and atrial fibrillation) substantially contribute to HF development in women, highlighting the need for sex-sensitive risk assessment.[23] Obesity risk rises sharply after 35 years, affecting nearly half of women aged 35–49, with marked regional variation. Exercise-based CR is a key non-pharmacological component of HF management. Contemporary evidence syntheses indicate that participation in exercise-based CR likely reduces the risk of all-cause and HF-related hospital admissions and likely improves health-related QoL, while it probably makes little to no difference in all-cause mortality.[24,25] These findings emphasize the need to consider the unique epidemiological profile of women with HF in planning management strategies and rehabilitation interventions.

Why tailored cardiac rehabilitation is central to care for women with heart failure

Comprehensive CR is recommended for clinically stable patients with HF as part of management, as it targets key contributors to disability such as exercise intolerance, deconditioning, comorbidity burden, adverse health behaviors, and psychosocial distress. Table 1 outlines typical CR exercise prescriptions for stable HF based on National Institute for Health and Care Excellence, American Heart Association (AHA)/American College of Cardiology/Heart Failure Society of America, and women-focused ICCPR recommendations.[26,27] In women, the need for CR is further amplified by (i) a higher HFpEF burden with prominent peripheral limitations, (ii) greater symptom burden and functional impairment, and (iii) persistent multilevel barriers to access and sustained participation.[9,30]

Table 1: Typical exercise-based CR prescription for stable HF (National Institute for Health and Care Excellence NG106; American Heart Association/American College of Cardiology/Heart Failure Society of America, Women-focused CR International Council of Cardiovascular Prevention and Rehabilitation)[11,26,27]

Component	Typical recommendation	Women-specific tailoring notes
Frequency	3–5 sessions/week for ≥12 weeks	Home/hybrid formats may increase reach
Intensity	Start low to moderate; progress as tolerated	Start at lower absolute loads (frailty, anemia, HFpEF fatigue: slower ramp)
Type	Aerobic (walk/cycle) ± resistance	Emphasize strength in older women; balance/falls[#]
Setting	Center-based OR home/tele-CR	Choose a fit-for-life model; culturally safe options

CR: cardiac rehabilitation, HFpEF: heart failure with preserved ejection fraction.

[#]Some women report preference for culturally familiar or low-impact activities (e.g., yoga, dance-based exercise, and tai chi), which may support engagement when incorporated within HF-appropriate exercise prescription[28,29]

A recent clinical practice guideline by ICCPR[26] advocates for a unique CR design for women where "tailoring" indicates need-based, delivered in accessible settings (home/community/hospital, faith-based institutions) and integrated with education, risk-factor management, and psychological support. The guideline emphasizes that the main "dose difference" is not a fundamentally different exercise prescription, but rather one that ensures access and fit, including proactive referral, flexible delivery models, women-centered education, and structured psychosocial support tailored to caregiving roles, social context, and mental health needs. This has been backed by a review article showing better adherence and sustained participation in women when such adaptations are made.[28]

Determinants of cardiac rehabilitation participation and outcomes in women

Biological determinants

In women with HF, exercise intolerance is often driven by reduced vascular reserve, skeletal muscle dysfunction, and chronotropic limitations, manifesting as early fatigue and dyspnea. In addition, life-course transitions modify risk and rehabilitation needs. Pregnancy-associated HF, including peripartum cardiomyopathy, occurs in the context of dynamic cardiovascular physiology and sometimes restricted pharmacologic options, demanding multidisciplinary cardio-obstetric care and closely monitored, individualized rehabilitation.[31,32] During and after menopause, clustering of cardiometabolic risk factors (hypertension, diabetes, and obesity) alongside the predominance of HFpEF makes structured physical activity and lifestyle-based secondary prevention central to care. As CR provides a scalable platform to deliver exercise training, risk-factor modification, and behavioral support tailored to symptom burden and comorbidities, it should be deployed for women across the age-spectrum and also be utilized as an HF prevention tool in high-risk women.[10,33]

Psychosocial and mental health dimension

Women with HF experience a substantial psychosocial burden that influences disease progression and treatment responsiveness. A meta-analysis of stress management interventions in HF revealed that women represented only 39% of participants despite high psychosocial distress, with participation influenced by hypertension and beta-blocker use.[34] Additionally, women with systolic HF exhibit higher depression scores and more frequent symptoms such as fatigue, low mood, and impaired concentration, all of which contribute to worse QoL and increased mortality.[35] Group-based or women-centered

CR provides peer support, normalization of symptoms, and reduced feelings of isolation, factors particularly relevant for women.

Sociocultural and health-system determinants

Women's access to CR is shaped by financial constraints, rural residence, caregiver roles, and sociocultural norms that limit mobility and available time, and health-system factors such as referral gaps and limited-service availability. Intersecting sociocultural responsibilities and health-system barriers significantly limit women's referral to, enrollment in, and completion of CR. These challenges are further compounded by health-system factors such as gaps in referral practices and the limited availability of CR services.[36]

Barriers and facilitators to cardiac rehabilitation participation

Barriers to CR participation among women also vary by region and socioeconomic status. Unemployed women in the Western Pacific and South-East Asia, including India, report significantly greater barriers and lower participation than women in other regions, whereas retired women and those receiving disability benefits report fewer barriers and higher participation. These patterns highlight the role of contextual constraints, particularly distance, transportation, and family responsibilities, in limiting CR uptake, adherence, and completion among women.[37] The major individual, family/household, and health-system barriers influencing CR uptake, adherence, and completion among women are summarized in Table 2. These findings underscore the need for system-level strategies to expand access to gender-responsive CR models globally.[38]

Table 2: Barriers in cardiac rehabilitation (CR)

Level	Barrier category	Examples (India-relevant)
Individual	Knowledge and beliefs	Low awareness of CR; fear of exercise; symptom normalization
	Clinical status	Frailty, anemia, multimorbidity, HFpEF fatigue
	Mental health	Depression/anxiety/ low-self-esteem
Family/household	Caregiving and time	Household work, childcare/ eldercare/limited autonomy over time
	Mobility constraints and safety	Need for accompaniment; safety concerns
Health system	Referral gap	Low clinician endorsement; no automatic referral
	Access and cost	Few programs; distance/ transport; out-of-pocket costs
	Workforce	Limited CR-trained staff

CR: cardiac rehabilitation, HFpEF: heart failure with preserved ejection fraction

Delivery formats to prioritize for women

- Home-based/hybrid/tele-CR: Flexible delivery models are particularly well-suited to women because they directly address time, travel, and caregiving responsibilities. In a case-control evaluation, women using a virtual rehabilitation platform achieved outcomes comparable to ambulatory CR and superior to controls, supporting digitally delivered CR as a feasible approach to improve adherence, recovery, and QoL.[39] Tele-CR has also been associated with improvements in functional capacity, physical activity adherence, and cardiovascular risk-factor control compared with usual care, with similar gains observed in HF and IHD populations.[39] Home-based CR trials in chronic HFrEF likewise demonstrate improvements in aerobic capacity, functional performance, and QoL, alongside fewer short-term readmissions.[40]
- Women-focused content modules: Beyond delivery mode, program content should be explicitly designed around women's needs, including symptom recognition and self-monitoring, confidence building, depression screening and referral pathways, role strain and caregiving demands, and culturally shaped constraints on mobility and time use. Women report high satisfaction with CR overall, and many prefer supervised formats. Additionally, women-only sessions may feel more comfortable and less competitive, although preferences vary by individual circumstance and scheduling feasibility.[29]
- Choice-based models and program fit: Evidence supports a choice-based approach rather than a single "best" model. In a randomized trial comparing supervised mixed-sex CR, supervised women-only CR, and home-based CR, adherence and satisfaction were high across groups, while supervised models were often preferred over home-based options, supporting flexible pathways that allow women to select the setting that fits their constraints and preferences.[29]
- Phenotype-aware pathways: Program intensity, progression, and monitoring should be aligned with HF phenotype and symptom burden. Women with HFpEF often require lower starting workloads, slower progression, greater emphasis on resistance training and fatigue management, and symptom-guided pacing.[41]

CR participation is particularly low among older, nonwhite women with multiple comorbidities, with younger age and IHD influencing participation, in the United States.[42] However, when women are enrolled, adherence is generally comparable to that of men, and improvements in peak VO_2 and QoL are similar, reinforcing that inequities are primarily in referral and access rather than effectiveness.[42,43]

Collectively, these findings reinforce that expanding CR beyond traditional center-based programs through home-based, women-centered, hybrid, and tele-CR pathways may enhance HF outcomes in women. Importantly, women-focused CR can be less accessible in practice if offered infrequently. In the CR4HER trial, women commonly crossed over from women-only to mixed-sex CR due to time conflicts with the single available women-only session, underscoring that "women-only" without flexible scheduling may not resolve access barriers.[44]

Figure 1 illustrates a tailored CR pathway for women with HF, integrating biological, psychosocial, and health-system determinants to guide referral, program design, delivery, and sustained participation.

Exercise prescription and safety in women with heart failure

Women with HF represent a heterogeneous group, and exercise intolerance reflects the interplay of central hemodynamic impairment and peripheral limitations. In HFpEF, which is more prevalent in women, reduced diastolic reserve and impaired peripheral oxygen utilization commonly manifest as early exertional dyspnea and fatigue. Across EF phenotypes, supervised and individualized exercise-based CR is generally safe when guided by appropriate clinical stability and risk stratification, and is associated with improvements in functional capacity and QoL; accordingly, major guidelines recommend personalized, exercise-based CR for clinically stable HF. Although the fundamental Frequency, Intensity, Time, and Type framework applies to both women and men, sex- and gender-related factors can shape the starting workload, rate of progression, monitoring requirements, and adherence. Women frequently enter CR with lower baseline cardiorespiratory fitness and muscle strength and may report exercise as more tiring or painful, particularly in the presence of multimorbidity, frailty, or musculoskeletal conditions.[45] Across CR cohorts, women may demonstrate smaller absolute increases in VO_2 peak despite similar attendance, although relative improvements in walking distance, activity levels, or patient-reported outcomes may be comparable and in some cohorts greater than those observed in men.[46]

These patterns support a prescription approach that is guideline-consistent yet progression-sensitive, using symptom-guided titration and deliberate resistance training to address strength and function. Low- to

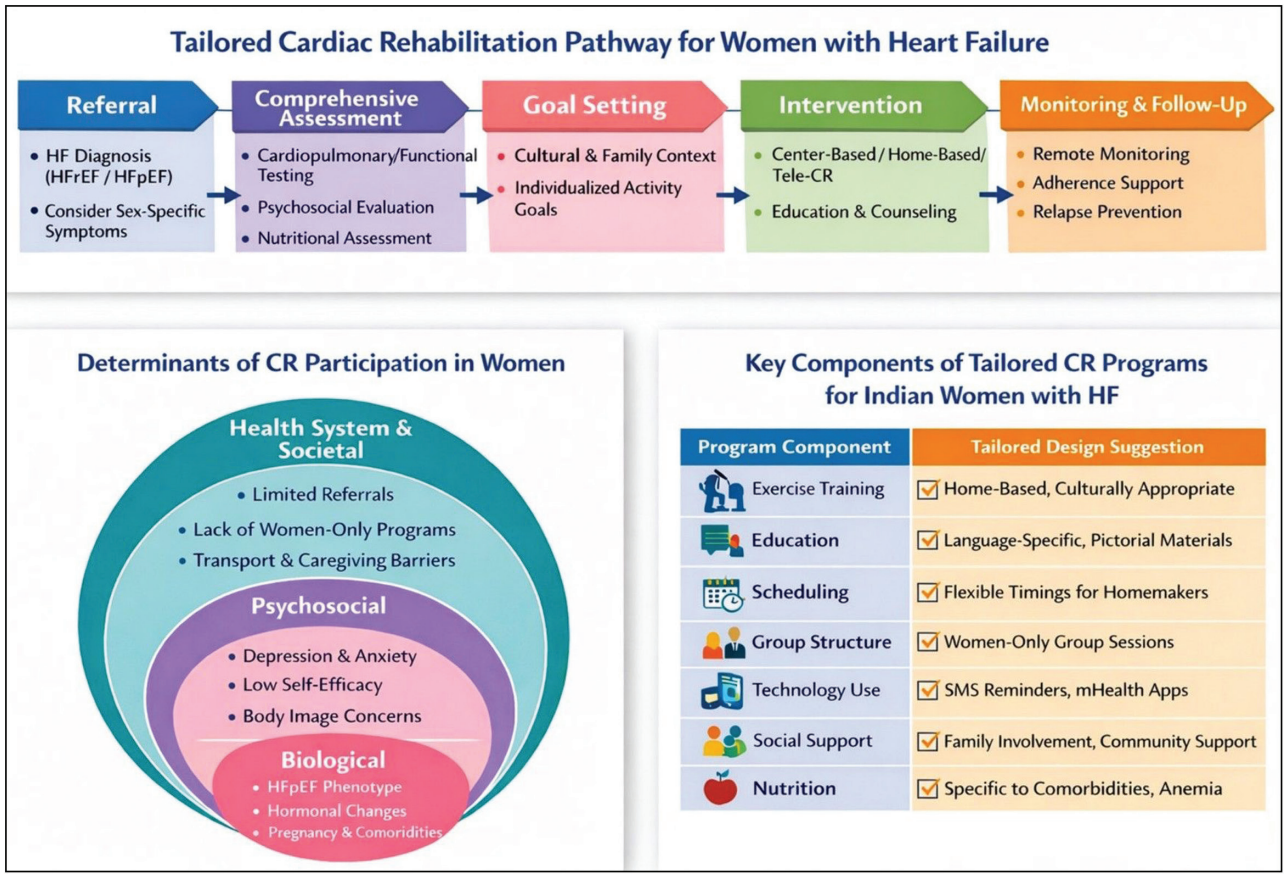


Figure 1: Tailored cardiac rehabilitation pathway for women with heart failure. Disclosure: This figure was created and refined using AI-based tools for graphical development (layout/illustration). All scientific content and interpretation were generated by the authors

moderate-intensity CR has been reported as safe in women with chronic HF without excess complications compared with men.[47] Early mobilization and exercise initiated after stabilization from acute decompensated HF can improve functional capacity and QoL without adverse effects; however, sex-specific analyses remain limited in many studies.

Exercise should be deferred or modified if there are signs of worsening congestion, such as rapid weight gain or increasing edema, resting dyspnea/orthopnea, symptomatic hypotension, new or worsening angina, or significant arrhythmia-related symptoms. When fatigue appears disproportionate, clinicians should review medication timing (particularly beta-blockers and diuretics), hydration and heat exposure, and evaluate for anemia or iron deficiency. In frail women or those limited by musculoskeletal conditions, programs should incorporate longer warm-up and cool-down periods, add balance training, and use pain-sensitive, gradual progression to support safety and adherence.[48] In women with HF, CR complements guideline-directed medical therapy by improving exercise tolerance, strengthening self-monitoring and symptom recognition, and supporting medication adherence; psychological support is particularly important given higher rates of anxiety and depression. These components are reflected in the typical exercise-based CR prescriptions for stable HF outlined in Table 1.[38,49]

Nutritional concerns for women with heart failure

Nutrition care in HF should be tailored to the individual, but we currently lack evidence to recommend "women-only" dietary targets. The HF nutrition literature rarely stratifies outcomes by sex. Women remain underrepresented in HF nutrition trials and CR nutrition studies, limiting the strength of sex-specific guidance. The unique nutritional requirements for women are based on their risk profile, body composition, and day-to-day realities and social context, which CR nutrition support should address directly. Restrictive diets may result in inadequate intake of essential macro- and micronutrients, increasing the risk of deficiencies in calcium, magnesium, zinc, iron, thiamin, folate, and vitamins D, E, and K. Intravenous iron improves outcomes in HFrEF; CR pathways should support detection and appropriate referral-based management of iron deficiency and other clinically significant deficits, integrated with dietary counseling.

Perhaps 10%–20% of ambulatory patients with systolic HF have distinctive muscle wasting with limited evidence to guide optimal screening and management strategies.[50] Women may appear "normal-weight" yet have low muscle mass and reduced functional reserve. CR programs should therefore use a low threshold for screening (e.g., weight trajectory, appetite, functional decline, grip strength/chair stand where feasible, and clinical indicators of sarcopenia/ frailty), rather than relying on BMI alone.

Dietary approaches to stop hypertension and Mediterranean plant-forward dietary patterns have evidence for improving function and QoL in cardiovascular populations and are reasonable anchors for counseling in HF, adapted to comorbidities common in women (hypertension, obesity, diabetes) and local dietary practices. Counseling should also consider women's frequent role in food preparation and household food allocation, which can influence feasibility and adherence.

Nutrition counseling should emphasize the prevention of malnutrition, cachexia, and sarcopenia, as well as adequate intake of macro- and micronutrients, and the avoidance of excessive salt intake. Although sex-specific dosing targets are not established, several practical priorities for CR can be justified based on the available evidence and the lived context of women with HF.

Women often face greater caregiving burdens, sociocultural constraints, and competing priorities that may lead them to deprioritize their own dietary needs. CR should incorporate individualized behavior-change strategies, ideally delivered by a dietitian where available, and consider structured family involvement, when appropriate, to support adherence and reduce practical barriers. Routine fluid restriction is not universally recommended, but an intake of 1.5–2.0 L/day can be individualized based on symptoms, weight changes, and climate, using culturally appropriate, patient and family-centered dietary counseling.[50,51]

Patient education in cardiac rehabilitation for women with heart failure

Patient education is a core component of comprehensive CR. Given the breadth of content and wide variation in health literacy, programs should first assess women's baseline knowledge, priorities, and preferred learning format, and then deliver education that is clear, culturally relevant, and clinically tailored. In addition to basic cardiovascular disease (CVD) education, women-focused content should highlight pregnancy- and menopause-related factors, psychosocial stressors, autoimmune comorbidities, cardiotoxicity associated with cancer treatments, and conditions that are more common or underdiagnosed in women, such as HFpEF, MINOCA, and microvascular dysfunction. Additionally, sex disparities in diagnostic processes and reaction to therapies, such as medication, revascularization, and CR, should be highlighted in education.[9,26]

Women with HF often benefit from education that is more psychosocially oriented, flexible, and relatable than standard mixed-sex CR education, and they may prefer different delivery modes than men. They often report higher symptom burden, depression, anxiety, and functional limitation than men despite frequently having higher

LVEF and, in some studies, better HF self-care knowledge; this increases the need for education on symptom interpretation, early warning signs, self-management, and coping strategies. Reviews consistently highlight women's greater need for content that goes beyond conventional risk-factor messaging, including caregiving roles, fatigue management, multimorbidity, body image, sexual health, and psychosocial well-being.[52] Women-focused curricula (e.g., Cardiac College for Women) that use co-designed, plain-language, multi-modal resources have demonstrated high engagement (around 80% session attendance with additional online use) and were rated as highly applicable to women's daily lives.[53]

Evidence for cardiac rehabilitation effectiveness in women with heart failure

Across observational cohorts and program evaluations, women demonstrate meaningful improvements in both physiological and patient-reported outcomes. Table 3 presents CR outcomes and effectiveness in women with HF, complemented by the AHA's scientific statement on CR in women, which provides a framework to operationalize equitable referral, delivery access, and sustained participation.

Program design considerations for cardiac rehabilitation in India

Global surveys identify key enablers for women's participation, including women-tailored content, staff training in women's CVD, flexible session timing, caregiver inclusion where appropriate, and virtual education options, features that directly target gendered barriers to participation. To clarify the evidence basis for the proposed Indian model, we distinguish: (a) evidence supported in India, (b) evidence supported in LMICs/elsewhere and plausibly transferable to India, and (c) expert-informed recommendations where direct Indian evidence is limited. Table 4 maps each proposed program element to its primary evidence level. Designing CR programs for India requires careful consideration of resource constraints, cultural norms, geographic barriers, and the high burden of comorbidities among women. Based on current evidence, women-tailored CR programs in India should prioritize scalability, affordability, and cultural adaptability.[38,58] A pragmatic Indian CR model could be anchored in a tele-CR backbone, leveraging smartphone platforms with flexible scheduling and local-language delivery to provide individualized exercise prescriptions derived from simple field-based assessments (such as the shuttle-walk test or 6 min walk test). Such platforms can also facilitate symptom and step tracking, educational video content in local language based on educational literacy, and two-way messaging, enhancing engagement and continuity of care.[43] Additionally, supervised women-only CR programs may further promote comfort and participation among women who experience gender-specific social or cultural constraints, thereby improving uptake and adherence [Figure 2].[29]

Table 3: Cardiac rehabilitation (CR) outcomes and effectiveness in women with heart failure (HF)

Domain	Key message in overall HF and women with HF	Effectiveness (direction)
Functional capacity	Exercise training improves peak VO_2 and 6MWD; gains in HFpEF are clinically meaningful and may be comparable to or greater than HFrEF in some analyses; home-based CR improved peak VO_2, 6MWD, and anaerobic threshold.[40,54-56] Although evidence is largely derived from mixed-sex cohorts, one study showed improved anaerobic threshold[40] and a predominantly female cohort[55] demonstrated significant improvements in 6MWD and peak VO_2, suggesting potential benefits in women despite limited sex-specific data.	↑ peak VO_2; ↑ 6MWD; ↑ anaerobic threshold.
QoL/health status	CR improves QoL and patient-reported health status in HF; women demonstrate QoL gains comparable to men; in obese older HFpEF, aerobic training and caloric restriction further improve function and QoL.[37,55]	↑ QoL/health status.
Hospitalizations	Evidence syntheses indicate exercise-based CR likely reduces the risk of all-cause and HF-related hospital admissions (typically assessed up to 12 months), although the magnitude varies across trials and settings.[25,40]	↓ all-cause/HF admissions; ↓ early readmission.
Mortality	Meta-analyses show exercise-based CR probably makes little to no difference in all-cause mortality; women-specific mortality effects remain uncertain due to underrepresentation and limited sex-stratified reporting.[25]	↔ mortality (overall evidence).
Symptoms/mental health	Women with systolic HF and depression report higher symptom burden; mental health affects engagement and outcomes.[35]	Psychosocial components → ↑ engagement/QoL (evidence mixed).
Clinical modifiers (India)	Indian HF registries indicate a high prevalence of iron deficiency and anemia in HFrEF, with adverse associations observed across both genders. The absence of detailed sex-stratified analyses limits conclusions regarding differential impact, but optimization may be important for improving functional capacity and rehabilitation outcomes.[57]	Anemia/iron deficiency → ↓ tolerance; treat to optimize CR response.

CR: cardiac rehabilitation, HF: heart failure, HFpEF: heart failure with preserved ejection fraction, HFrEF: heart failure with reduced ejection fraction, QoL: quality of life, 6MWD: 6-minute walking distance

Table 4: Evidence mapping for proposed women-focused CR program design in India (evidence labels: India-supported, LMIC/Global—transferable, India—emerging, Expert-informed)

Program element in the proposed India model	Evidence level	What supports it (brief)	Key sources
HF case mix in India (phenotypes, admissions) and comorbidity burden shaping CR needs	India-supported	Indian registry data and India-based cohorts inform phenotype distribution, symptom burden, and comorbidity patterns relevant to exercise tolerance and risk stratification	NHFR and India registry analyses[4-6]; anemia/iron deficiency registry data[63]
Limited CR availability/capacity in India	India-supported	Indian CR audit/ICCPR global audit data highlight gaps in program availability and staffing, supporting the need for scalable models	ICCPR global audit/India data[60]
Women-tailored participation enablers (flexible timing, tailored content, psychosocial support, caregiver-sensitive delivery)	LMIC/Global—transferable	Multi-country/global assessments and systematic reviews show common barriers for women and program enablers that improve participation across regions	ICCPR global assessment + women-focused delivery papers[37,38]; systematic review of women-focused CR[52]
Tele-/technology-enabled CR backbone (local-language coaching, symptom/step tracking, messaging, education content)	India—emerging + LMIC/Global—transferable	India-registered/middle-income setting trials support feasibility; broader LMIC/global evidence supports remote delivery as an access solution, with outcomes dependent on program design and adherence	Technology-based CR trial for women[58]; virtual/remote CR evidence[39]; home-based HF CR trial[40]
Home-based/hybrid CR pathways to overcome travel/time constraints	Global—transferable	Trials and syntheses support feasibility and benefits for functional capacity and HRQoL; hospitalization reductions are typically modest/variable; mortality effects are less consistent	Cochrane HF CR synthesis[25]; HF and home-based evidence[40,48,49]
Women-only supervised sessions (where sociocultural constraints exist)	Global—transferable; context-dependent	RCTs/program evaluations show acceptability and potential adherence benefits for some women; scheduling feasibility and access determine real-world utility	Women's model preference RCT and related work[29,44]
Discharge-based referral "capture point" after HF hospitalization	Expert-informed (supported by India patterns)	Implementation logic: hospitalization is the most reliable contact point for referral; rationale supported by India HF admission patterns, but operational pathway is an implementation proposal	India registry admission patterns[4,5] + implementation rationale
Task-sharing workforce model (nurse/physio health coaches with cardiology oversight; escalation protocols)	LMIC—transferable + Expert-informed	Task-sharing evidence supports feasibility in resource-constrained settings; details of CR task allocation and escalation pathways require local adaptation	Task-shifting/task-sharing scoping review[59] + program feasibility principles
Equity targeting + financial protection (rural outreach, low-cost delivery, reimbursement/coverage where possible)	Expert-informed (with supportive global implementation evidence)	Equity and affordability are essential for reach; specific financing mechanisms require India policy decisions and local program development	Women-focused CR implementation enablers[37,38] + India CR capacity constraints[60]

CR: cardiac rehabilitation, RCTs: randomized controlled trials, QoL: quality of life, ICCPR: International Council of Cardiovascular Prevention and Rehabilitation, LMIC: low and middle-income countries

Core cardiac rehabilitation design features for India

1. Capture point: discharge-based referral for hospitalized HF (aligned with registry case mix and admission patterns).
2. Model: brief in-person assessment + tele-CR backbone using local language, WhatsApp/app, and simple field tests (6 min walking test/shuttle walk) to generate prescriptions and monitor symptoms/steps.
3. Workforce: task-sharing-nurses/physiotherapists as health coaches under cardiologist oversight; standardized protocols and escalation pathways.
4. Equity targeting: prioritize rural women, low socioeconomic groups, across phenotypes, pregnancy-related HF, and frail older women; incorporate financial protection or reimbursement where possible.

Health-system and policy considerations

Globally, women-focused CR remains uncommon. An audit-derived global estimate (summarized in a systematic review) suggests women-focused CR is available in approximately 41% of countries that have CR services, with ~32% of programs in those countries offering it; definitions of "women-focused" vary widely (women-only vs selected sessions vs gender-tailored content).[52] More recent international survey data also indicate low implementation, with only 14.8% of responding CR programs reporting any women-focused programming.[36] In low-middle-income settings such as India, where CR availability is already limited, this scarcity of women-focused options likely compounds gender inequities, strengthening the case for scalable women-centered models (home-based/hybrid/tele-CR) integrated with discharge referral and follow-up pathways.

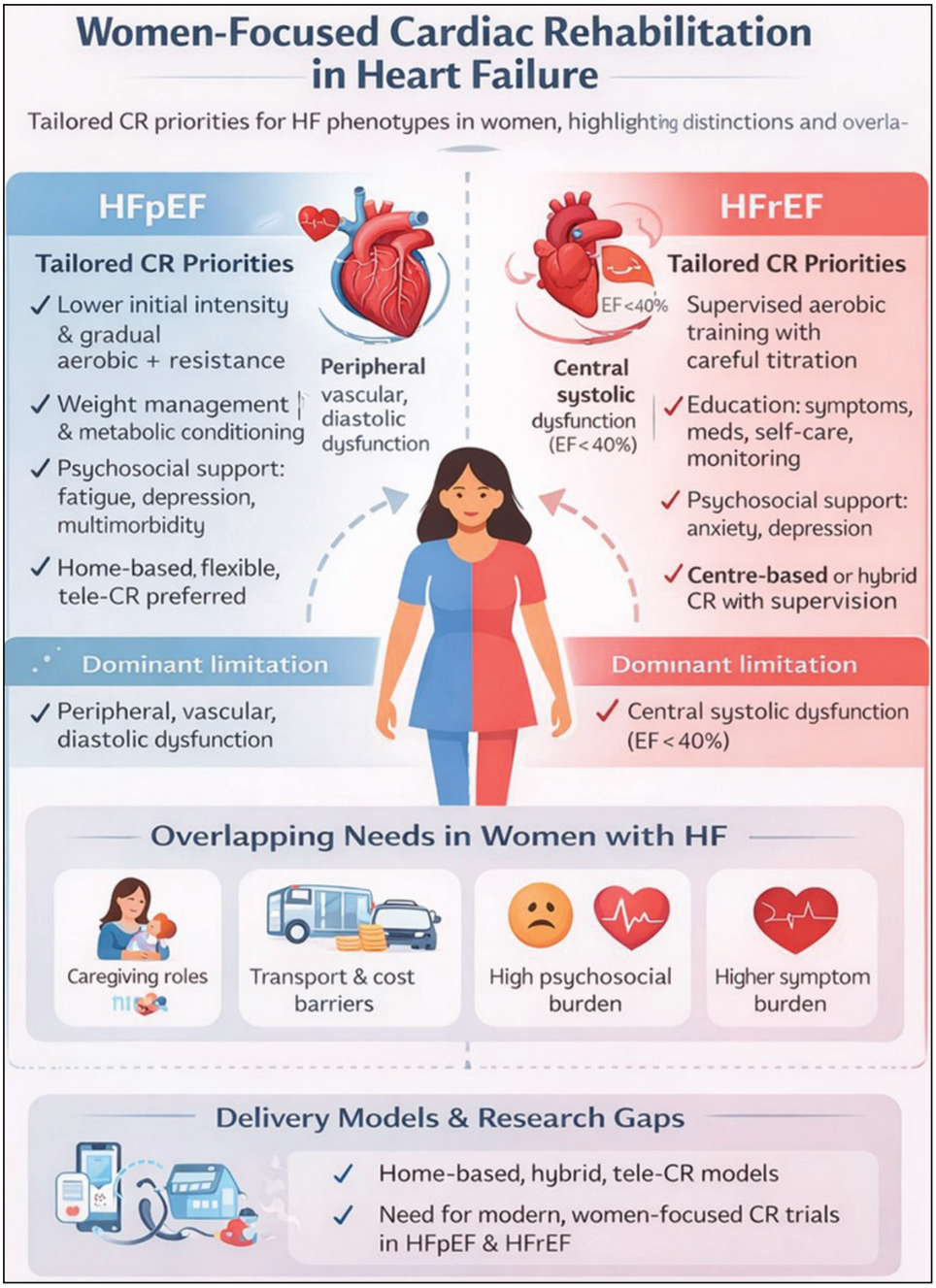


Figure 2: Women-focused cardiac rehabilitation in heart failure. Disclosure: This figure was created and refined using AI-based tools for graphical development (layout/illustration). All scientific content and interpretation were generated by the authors

A gender-responsive, system-level approach is therefore needed, including integration of CR into public health systems and stronger referral systems. Financial protection (coverage and reimbursement) is essential to reduce out-of-pocket costs. Establishing community linkages with partnering women's self-help groups can enhance social support and improve adherence. In addition, task-sharing models that utilize trained nurses as health coaches and physiotherapist lead under cardiologist oversight can improve feasibility and scalability. Low-intensity exercise and in-person sessions should be prioritized for higher-risk populations, including women with HFpEF, pregnancy-related heart disease, and frail older women.[31,59,60]

Future Research Priorities

Women have historically been disproportionately underrepresented in clinical studies that target particular nutritional recommendations, the role of medication adherence and side effects, exercise-based and psychosocial therapies, and stress management programs.[25,34,42,61,62] This underrepresentation limits the ability to generalize

findings and develop evidence-based, sex and gender-responsive rehabilitation strategies. Future research should prioritize women-centered CR, including home-based and technology-supported models, address barriers to accessibility and adherence, particularly in low- and middle-income settings, and focus on scalable, cost-effective implementation. Sex-stratified trial designs, mechanistic studies in women across phenotypes, and outcomes beyond exercise capacity, including fatigue, QoL, and psychosocial well-being, with consistent sex-disaggregated reporting, are essential to advance equitable CR services for women.

Conclusions

Women with HF face unique challenges that limit participation in comprehensive CR, including sociocultural barriers, caregiver responsibilities, and limited program access. Tailored patient-centered CR models such as home-based, hybrid, tele-rehabilitation, and culturally adapted programs can improve engagement, functional recovery, and long-term outcomes. In India, developing sex-specific and culturally sensitive CR programs, supported by policy, clinician training, and research, is essential to reduce disparities and optimize cardiovascular care for women.

Acknowledgment

The authors acknowledge the use of AI-based tools solely for figure creation and graphical development (layout/illustration), while all scientific content, interpretation, and conclusions were generated by the authors.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Abbreviations

AHA: American Heart Association
ANOCA: Angina with non-obstructive coronary arteries
CR: Cardiac rehabilitation
EF: Ejection fraction
HF: Heart failure
HFmrEF: Heart failure with mildly reduced ejection fraction
HFpEF: Heart failure with preserved ejection fraction
HFrEF: Heart failure with reduced ejection fraction
HFSA: Heart Failure Society of America
ICCPR: International Council of Cardiovascular Prevention and Rehabilitation
IHD: Ischemic heart disease
INOCA: Ischemia with non-obstructive coronary arteries
LVEF: Left ventricular ejection fraction
MINOCA: Myocardial infarction with non-obstructive coronary arteries
NICE: National Institute for Health and Care Excellence
NHFR: National Heart Failure Registry of India
QoL: Quality of life

References

1. Bozkurt B, Coats AJS, Tsutsui H, Abdelhamid CM, Adamopoulos S, Albert N, *et al*. Universal definition and classification of heart failure: A report of the Heart Failure Society of America, Heart Failure Association of the European Society of Cardiology, Japanese Heart Failure Society and Writing Committee of the Universal Definition of Heart Failure: Endorsed by the Canadian Heart Failure Society, Heart Failure Association of India, Cardiac Society of Australia and New Zealand, and Chinese Heart Failure Association. Eur J Heart Fail 2021;23:352-80.
2. Feng J, Zhang Y, Zhang J. Epidemiology and burden of heart failure in Asia. JACC Asia 2024;4:249-64.
3. Ibănescu R, Mîțu DA, Goje ID, Goje GI, Lighezan DF. History of heart failure definition. Card Fail Rev 2025;11:e07.
4. Harikrishnan S, Bahl A, Roy A, Mishra A, Prajapati J, Manjunath CN, *et al*.; NHFR investigators. Clinical profile and 90 day outcomes of 10 851 heart failure patients across India: National Heart Failure Registry. ESC Heart Fail 2022;9:3898-908.
5. Jayagopal PB, Manjunath CN, Jabir A, Sastry SL, Nanjappa V, Vaidyanathan PR, *et al*. Do gender differences matter in acute heart failure? Insights from Indian College of Cardiology – National Heart Failure Registry, India. Int J Cardiol Cardiovasc Risk Prev 2025;26:200441.
6. Kole A, Agarwal A, Seth B, Sandhu S, Ghali B, Arya P, *et al*. Epidemiology of heart failure in rural Chhattisgarh, India. Natl Med J India 2024;36:163-6.
7. Chun K, Kang SM. Cardiac rehabilitation in heart failure. Int J Heart Fail 2021;3:1-14.
8. Bjarnason-Wehrens B, Grande G, Loewel H, Völler H, Mittag O. Gender-specific issues in cardiac rehabilitation: Do women with ischaemic heart disease need specially tailored programmes? Eur J Cardiovasc Prev Rehabil 2007;14:163-71.
9. Coutinho T, Khadanga S, Adedinsewo D, Barac A, Brown TM, Deaton C, *et al*.; American Heart Association Exercise, Cardiac Rehabilitation, and Sports Cardiology Science Committee of the Council on Clinical Cardiology; Women's Health Science Committee of the Council on Clinical Cardiology and Stroke Council; Council on Cardiopulmonary, Critical Care, Perioperative and Resuscitation; Council on Cardiovascular and Stroke Nursing; Council on Lifestyle and Cardiometabolic Health; and Council on Quality of Care and Outcomes Research. Cardiac rehabilitation in women: A scientific statement from the American Heart Association. Circulation 2025;152:e376-90.
10. Shan S, Sun W, Wu J, Zhu Y, Song P. Population attributable risk of traditional, under-recognised and female-specific factors for heart failure in women. Heart 2025;112:199-207.
11. Heidenreich PA, Bozkurt B, Aguilar D, Allen LA, Byun JJ, Colvin MM, *et al*; ACC/AHA Joint Committee Members. 2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. Circulation 2022;145:e895-e1032.
12. Kaur G, Lau E. Sex differences in heart failure with preserved ejection fraction: From traditional risk factors to sex-specific risk factors. Women's Health (London, England) 2022;18:17455057221140209.
13. Yerram S, Maddury J. A review of heart failure in women – The Indian perspective. Heart Fail J India 2023;1:26-30.
14. Kishanrao S. Congestive heart failure in Indian elders. Clin Cardiovasc Res 2023;2:01-4.
15. Hemnath C, Mahilmaran A. Dissimilarities in females having heart failure with mildly reduced ejection fraction. Asian J Cardiol Res 2023;6:281-8.

16. Lam CSP, Lyass A, Kraigher-Krainer E, Massaro JM, Lee DS, Ho JE, *et al*. Cardiac dysfunction and noncardiac dysfunction as precursors of heart failure with reduced and preserved ejection fraction in the community. Circulation 2011;124:24-30.
17. Scantlebury DC, Borlaug BA. Why are women more likely than men to develop heart failure with preserved ejection fraction? Curr Opin Cardiol 2011;26:562-8.
18. Beale AL, Meyer P, Marwick TH, Lam CSP, Kaye DM. Sex Differences in cardiovascular pathophysiology. Circulation 2018;138:198-205.
19. Radakrishnan A, Agrawal S, Singh N, Barbieri A, Shaw LJ, Gulati M, *et al*. Underpinnings of heart failure with preserved ejection fraction in women – From prevention to improving function. A co-publication with the American Journal of Preventive Cardiology and the Journal of Cardiac Failure. Am J Prev Cardiol 2025;23:100928.
20. Stahl ME, Weeldreyer NR, MacNamara JP, Lozano PFR, Allen JD. Exercise rehabilitation for heart failure and associated cardiomyopathies. Curr Cardiol Rep 2025;27:171.
21. Dewan P, Rørth R, Jhund PS, Shen L, Raparelli V, Petrie MC, *et al*. Differential impact of heart failure with reduced ejection fraction on men and women. J Am Coll Cardiol 2019;73:29-40.
22. Scrutinio D, Guida P, Passantino A, Lagioia R, Raimondo R, Venezia M, *et al*. Female gender and mortality risk in decompensated heart failure. Eur J Intern Med 2018;51:34-40.
23. Cesaroni G, Mureddu GF, Agabiti N, Mayer F, Stafoggia M, Forastiere F, *et al*.; PREDICTOR Study Group. Sex differences in factors associated with heart failure and diastolic left ventricular dysfunction: A cross-sectional population-based study. BMC Public Health 2021;21:415.
24. Redfield MM, Borlaug BA. Heart failure with preserved ejection fraction: A review. JAMA 2023;329:827-38.
25. Molloy C, Long L, Mordi IR, Bridges C, Sagar VA, Davies EJ, *et al*. Exercise-based cardiac rehabilitation for adults with heart failure. Cochrane Database Syst Rev 2024;2024:167.
26. Ghisi GL de M, Marzolini S, Price J, Beckie TM, Mamataz T, Naheed A, *et al*. Women-focused cardiovascular rehabilitation: An international council of cardiovascular prevention and rehabilitation clinical practice guideline. Can J Cardiol 2022;38:1786-98.
27. Chronic heart failure in adults: Diagnosis and management. London: National Institute for Health and Care Excellence (NICE); 2025. Available from: https://www.ncbi.nlm.nih.gov/books/NBK618692/. [Last accessed on 25 February 2026]
28. Vidal-Almela S, Czajkowski B, Prince SA, Chirico D, Way KL, Pipe AL, *et al*. Lessons learned from community- and home-based physical activity programs: A narrative review of factors influencing women's participation in cardiac rehabilitation. Eur J Prev Cardiol 2021;28:761-78.
29. Andraos C, Arthur HM, Oh P, Chessex C, Brister S, Grace SL. Women's preferences for cardiac rehabilitation program model: A randomized controlled trial. Eur J Prev Cardiol 2015;22:1513-22.
30. Supervia M, Jose R, Medina-Inojosa JR, Yeung C, Lopez-Jimenez F, Squires RW, *et al*. Cardiac rehabilitation for women: A systematic review of barriers and solutions. Mayo Clin Proc 2018;1:23.
31. Afari H, Sheehan M, Reza N. Contemporary management of cardiomyopathy and heart failure in pregnancy. Cardiol Ther 2024;13:17-37.
32. DeFilippis EM, Haythe JH, Walsh MN, Kittleson MM. Intersection of heart failure and pregnancy: Beyond peripartum cardiomyopathy. Circ Hear Fail 2021;14:e008223.
33. Eaton CB, Pettinger M, Rossouw J, Martin LW, Foraker R, Quddus A, *et al*. Risk factors for incident hospitalized heart failure with preserved versus reduced ejection fraction in a multiracial cohort of postmenopausal women. Circ Hear Fail 2016;9:1-9.
34. Scott-Sheldon LAJ, Gathright EC, Salmoirago-Blother E, Wu W-C. Women's participation in stress management interventions for chronic heart failure: A meta-analysis of randomized controlled trials. Psychol Health Med 2022;27:761-79.
35. Piepenburg SM, Faller H, Störk S, Ertl G, Angermann CE. Symptom patterns and clinical outcomes in women versus men with systolic heart failure and depression. Clin Res Cardiol 2019;108:244-53.
36. Supervía M, Medina-Inojosa JR, Yeung C, Lopez-Jimenez F, Squires RW, Pérez-Terzic CM, *et al*. Cardiac rehabilitation for women: A systematic review of barriers and solutions. Mayo Clin Proc 2017;92:565-77.
37. De Melo Ghisi GL, Kim W-S, Cha S, Aljehani R, Cruz MMA, Vanderlei LCM, *et al*. Women's Cardiac Rehabilitation Barriers: Results of the International Council of Cardiovascular Prevention and Rehabilitation's First Global Assessment. Can J Cardiol 2023;39:S375-83.
38. De Melo Ghisi GL, Supervia M, Turk-Adawi K, Beleigoli A, Contractor A, Mampuya WM, *et al*. Women-focused cardiac rehabilitation delivery around the world and program enablers to support broader implementation. CJC Open 2024;6:425-35.
39. Lăcraru A-E, Busnatu S-S, Pană M-A, Olteanu G, Șerbănoiu L, Gand K, *et al*. Assessing the efficacy of a virtual assistant in the remote cardiac rehabilitation of heart failure and ischemic heart disease patients: Case-control study of Romanian adult patients. Int J Environ Res Public Health 2023;20:3937.
40. Chen YW, Wang CY, Lai YH, Liao YC, Wen YK, Chang ST, *et al*. Home-based cardiac rehabilitation improves quality of life, aerobic capacity, and readmission rates in patients with chronic heart failure. Medicine (Baltim) 2018;97:e9629.
41. Mirzai S, Sandesara U, Haykowsky MJ, Brubaker PH, Kitzman DW, Peters AE. Aerobic, resistance, and specialized exercise training in heart failure with preserved ejection fraction: A state-of-the-art review. Heart Fail Rev 2025;30:1015-34.
42. Park LG, Schopfer DW, Zhang N, Shen H, Whooley MA. Participation in cardiac rehabilitation among patients with heart failure. J Card Fail 2017;23:427-31.
43. Campinas A, Schmidt C, Oliveira MI, Magalhães S, Gomes C, Nogueira-Ferreira R, *et al*. Effectiveness of a cardiac rehabilitation program in women with heart failure. Rev Port Cardiol 2025;44:525-32.
44. Grace SL, Midence L, Oh P, Brister S, Chessex C, Stewart DE, *et al*. Cardiac rehabilitation program adherence and functional capacity among women: A randomized controlled trial. Mayo Clin Proc 2016;91:140-8.
45. Bouakkar J, Pereira TJ, Johnston H, Pakosh M, Drake JDM, Edgell H. Sex differences in the physiological responses to cardiac rehabilitation: A systematic review. BMC Sports Sci Med Rehabil 2024;16:74.
46. Rengo JL, Khadanga S, Savage PD, Ades PA. Response to exercise training during cardiac rehabilitation differs by sex. J Cardiopulm Rehabil Prev 2020;40:319-24.
47. Wise FM, Patrick JM. Cardiac rehabilitation outcomes in women with chronic heart failure. J Cardiopulm Rehabil Prev 2012;32:78-84.
48. Taylor JL, Myers J, Bonikowske AR. Practical guidelines for exercise prescription in patients with chronic heart failure. Heart Fail Rev 2023;28:1285-96.
49. Bozkurt B, Fonarow GC, Goldberg LR, Guglin M, Josephson RA, Forman DE, *et al*; ACC's Heart Failure and Transplant Section and Leadership Council. Cardiac rehabilitation for patients with heart failure. J Am Coll Cardiol 2021;77:1454-69.
50. Vest AR, Chan M, Deswal A, Givertz MM, Lekavich C, Lennie T, *et al*. Nutrition, obesity, and cachexia in patients with heart failure: A consensus statement from the heart failure society of America scientific statements committee. J Card Fail 2019;25: 380-400.
51. McDonagh TA, Metra M, Adamo M, Gardner RS, Baumbach A, Böhm M, *et al*; Authors/Task Force Members. 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. Eur J Heart Fail 2022;24:4-131.
52. Mamataz T, Ghisi GLM, Pakosh M, Grace SL. Nature, availability, and utilization of women-focused cardiac rehabilitation: A systematic review. BMC Cardiovasc Disord 2021;21:459.
53. Carson RP, Grace SL, Bomtempo APD, Hebert A, Ross M, Oh P, *et al*. A multi-site mixed-method evaluation of "Cardiac College for Women" implementation: Perspectives of cardiac rehabilitation patients and providers. Front Cardiovasc Med 2024;11:1-12.

54. Pandey A, Parashar A, Kumbhani DJ, Agarwal S, Garg J, Kitzman D, *et al*. Exercise training in patients with heart failure and preserved ejection fraction. Circ Heart Fail 2015;8:33-40.
55. Kitzman DW, Brubaker P, Morgan T, Haykowsky M, Hundley G, Kraus WE, *et al*. Effect of caloric restriction or aerobic exercise training on peak oxygen consumption and quality of life in obese older patients with heart failure with preserved ejection fraction. JAMA 2016;315:36-46.
56. Scrutinio D, Guida P, Dalla Vecchia LA, Corrà U, Passantino A. Cardiac rehabilitation for older women with heart failure. J Pers Med 2022;12:1980.
57. Negi PC, Dev M, Paul P, Pal Singh D, Rathoure S, Kumar R, *et al*. Prevalence, risk factors, and significance of iron deficiency and anemia in nonischemic heart failure patients with reduced ejection fraction from a Himachal Pradesh heart failure registry. Indian Heart J 2018;70:S182-8.
58. Menezes HJ, Grace SL, Padmakumar R, Babu AS, Rao RR, Kamath A, *et al*. Technology-based comprehensive cardiac rehabilitation therapy for women in a middle-income setting: A randomized controlled trial. Eur J Prev Cardiol 2025;00:1-12.
59. Fell B, Joseph C, Smythe T. Task shifting and task sharing for rehabilitation in primary care – A scoping review. Rehabil Adv Dev Heal Syst 2025;2:a32.
60. Babu AS, Turk-Adawi K, Supervia M, Jimenez FL, Contractor A, Grace SL. Cardiac rehabilitation in India: Results from the international council of cardiovascular prevention and rehabilitation's global audit of cardiac rehabilitation. Glob Heart 2020;15:28.
61. Lewinter C, Doherty P, Gale CP, Crouch S, Stirk L, Lewin RJ, *et al*. Exercise-based cardiac rehabilitation in patients with heart failure: A meta-analysis of randomised controlled trials between 1999 and 2013. Eur J Prev Cardiol 2015;22:1504-12.
62. Taylor RS, Walker S, Ciani O, Warren F, Smart NA, Piepoli M, *et al*. Exercise-based cardiac rehabilitation for chronic heart failure: The EXTRAMATCH II individual participant data meta-analysis. Health Technol Assess 2019;23:1-98.
63. Flynn KE, Piña IL, Whellan DJ, Lin L, Blumenthal JA, Ellis SJ, *et al*.; HF-ACTION Investigators. Effects of exercise training on health status in patients with chronic heart failure: HF-ACTION randomized controlled trial. JAMA 2009;301:1451-9.

Supplementary File 1: Search strategy for PubMed

women OR female AND “heart failure” OR “Cardiac failure” OR “ventricular dysfunction” AND “cardiac rehabilitation” OR “cardiovascular rehabilitation” OR “exercise-based cardiac rehabilitation” OR “home-based cardiac rehabilitation” OR “technology-based cardiac rehabilitation” OR tele-rehabilitation AND “tailored rehabilitation” OR “individualized rehabilitation” OR “personalized rehabilitation” OR “gender-specific rehabilitation” OR “culturally tailored interventions” OR “customized exercise programs” AND ((y_10[Filter]) AND (ffrft[Filter]) AND (excludepreprints[Filter]) AND (humans[Filter]) AND (female[Filter]) AND (english[Filter]))